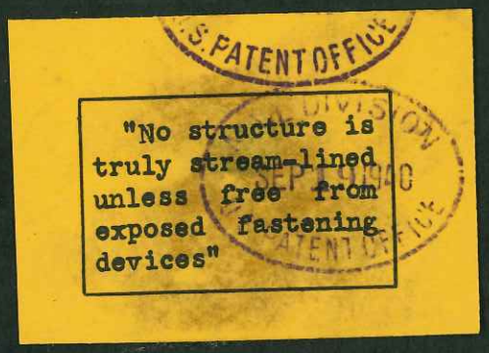
Schaefer

PERMAGRIP

296
30

The New
CONCEALED METHOD
FOR
Streamline
CONSTRUCTION

Ernest Schaefer — Cleveland, Ohio


U.S. PATENT OFFICE
"No structure is truly stream-lined unless free from exposed fastening devices"

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Schaefer PERMAGRIP

The New CONCEALED METHOD FOR Streamline CONSTRUCTION

All types of Schaefer PERMAGRIP fasteners are "concealed" fasteners. All combine a rigid inner hold with an unobstructed outer surface. Each kind is designed for its own intended use. Simplicity and rigidity make them practical for mass production and for limited production. Various types of construction have been developed to meet the requirements in different industries. A few of them are listed herewith.

All-Metal construction (sheet or plate), in strain-bearing and semi-strain-bearing types. Both ferrous and non-ferrous metals can now be used successfully in many new ways.

Metal-Clad construction built either over wood, or manufactured board, fibre, plastics, etc. Ideal for production of streamlined structures, also for permanent and removable panels such as used in wall and ceiling ornamentation, in fireproofing, in refrigeration, in air conditioning, in acoustic treatment, etc. Note: this type of construction can feature an outer metal covering that is practically strain-free.

All-Wood construction with the fasteners either partly exposed or entirely concealed. Insulation of the fastener can be provided to resist conduction of heat, cold, sound, etc., if desired.

An armor attachment method (for sheets and plates). Requires no holes through the armor, nor any welding of same. Makes possible greater protective qualities in the armor and a neater appearance.

Secure Anchorage for concealed attachment of parts, also building and machinery equipment. For hanging of heavy doors, for installation of machinery guards, for streamlined machinery enclosures, for signs, for bulletin boards, etc.

Your own requirements may be special: if so write us stating carefully just what you desire to accomplish. Correspondence invited.

PATENT APPLIED FOR

Ernest Schaefer

Schaefer PERMAGRIP Enterprises
4176 West 208th St.
Cleveland, O., U.S.A.

MAIL DIVISION
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PERMAGRIP
The New
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for
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I N T R O D U C T I O N

PERMAGRIP originated in the commercial truck body industry, where it furnished the satisfactory solution to the problems brought on by the demands of sleek smooth modern streamlining. Although much of this text matter was written in general to illustrate methods of application in this industry IT IS BY NO MEANS CONFINED THERETO. Scores of other industries require this simple strong concealed "fastening method" which relieves the outer metal surface of objectionable "exposed" fasteners such as nuts, and heads of bolts, rivets, screws and nails, and of joint-mouldings and the like.

Designed for mass-production and for individual unit construction, PERMAGRIP CONCEALED FASTENERS of various types (some illustrated herein) are supplied for wood-and-metal construction and for all-metal structures. Absence of holes in the outer surface enhances its appearance and frees it of harmful strains. Suitable for ferrous and for non ferrous metals. Favors the finer metals because they are installed without disfiguring their fine surface. PERMAGRIP requires no prohibitive investment in costly dies and plant equipment.

PERMAGRIP brings about new and improved uses for plywood, wall board, plastics, insulation materials, baked enamel sheets and plates, molded sections, armor plate, and a wide variety of nonferrous metals. Plain flat or curved sections; baked and moulded objects in various styles shapes and sizes can be successfully assembled with PERMAGRIP. Building "for export" is also made practical, because the ultimate user assembles his units at destination, in a simple effective and secure way.

Classed among the industries which must design and build to resist vibration, travel-shocks, momentum, impact, carrying-strains, etc., are: trucks, trailers, street cars, trains, coaches, ships, boats, aeroplanes, etc.

The simple secure fastening of panels and other objects is also essential in the production of store-fronts, walls, ceilings, partitions, elevator enclosures, metal roofs, portable garages, factory built homes, ready made factory buildings, etc. - In the erection of baked enamel structures such as streamlined filling stations, etc. - In the manufacture of counters, furniture, cabinets, bar fixtures, soda fountains, etc. - In the production of fire resisting office safes and filing equipment. - In the manufacture of armored booths, walls, cabs, etc. - In the production of refrigerated, insulated, and heated units. - In the manufacture of signs and bulletin boards, etc. etc.

Familiarize yourself properly BY READING AND STUDYING THE WHOLE TEXT. Correspondence is invited. Practical help on construction problems is available at reasonable cost. PERMAGRIP SHOP-RIGHTS, PERMAGRIP TOOLS, and PERMAGRIP CONCEALED FASTENERS supplied to the trade.

address: E r n e s t S c h a e f e r,
Schaefer PERMAGRIP Enterprises ~~20687 Iroquois Ave.~~ Cleveland Ohio USA

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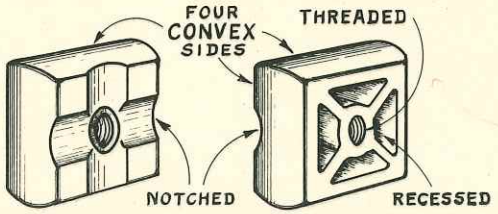
PLATE (L)

Schaefer
CONVEX RECTANGULAR PERMAGRIP



— PATENT APPLIED FOR —

PERMAGRIP "STRAIN-BEARING" PANEL CONSTRUCTION

NOTE: *This type of construction was developed for installations that require outer panels to carry "strains" — it differs therefore from the standard* PERMAGRIP *method, which features outer panels that are practically "free" from carrying strains.* — TWO TYPES SHOWN: — SEE SKETCHES EEE & FFF —

AS SHOWN IN SKETCH (DDD)

LIGHT GAUGE STRAIN-BEARING PANELS

SKETCH EEE

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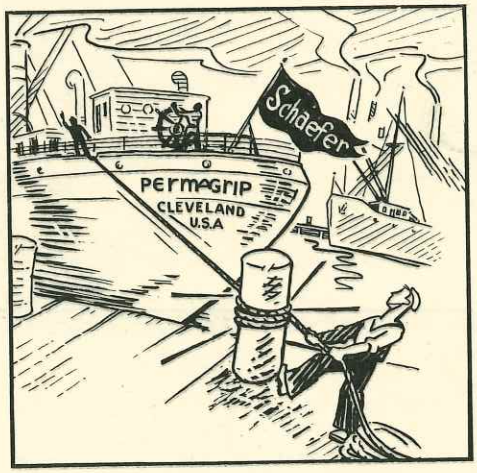
AS IN CORDAGE AND TEXTILES

PERMAGRIP construction, which wraps the outer sheet metal, and holds it securely along its entire back flanges, introduces to metal fabrication an old principle which has long been used successfully in the cordage and textile industries.

Note the sailor in the picture. By wrapping his rope around the snubbing post, he obtains maximum pulling capacity of the line on one end, while his back hold on the other end is made secure with comparatively little effort on his part.

Similarly, in the attachment of cloth to a frame-work, it is a commonly accepted practice to draw the material around to the back of the frame for attachment there.



It is obvious that any perforations which might be made through the strain bearing sections of the materials in either case, would reduce their strain capacity. To illustrate this point, it may be helpful to consider here, how easily even high grade paper stock in a check book, will tear along the perforated lines.

In PERMAGRIP construction the outer metal surface is entirely free from perforations; — also entirely free from spot contacts such as are encountered in welding, etc. — PERMAGRIP provides a sleek, smooth, streamlined outer surface. This new development provides increased rigidity in methods of attachment. The various types of PERMAGRIP fasteners are all designed for concealment from view.

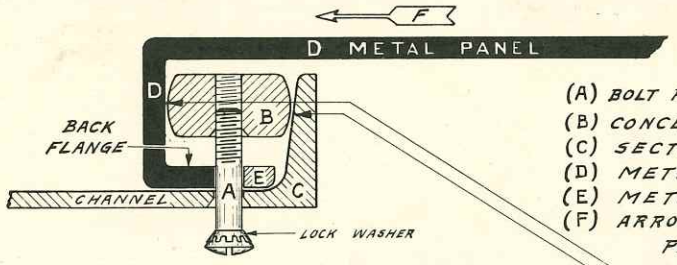
SEE INSIDE PAGES

PERMAGRIP TENSION METHOD

SKETCH D D D

USED IN MAKING THE ENTIRE PANEL
"STRAIN-BEARING" ALONG ALL EDGES
NO EXPOSED FASTENING DEVICES — NO HOLES THROUGH PANELS
NO "SPOT" CONTACTS — REQUIRES NO PANEL WELDING

—Strictly "all metal" Construction—



(A) BOLT READY TO DRAW DOWN FASTENER "B"
(B) CONCEALED PERMAGRIP FASTENER
(C) SECTION OF CHANNEL FRAME
(D) METAL PANEL
(E) METAL SHIM
(F) ARROW INDICATING DIRECTION OF PANEL TENSION.

THE EFFECT OF TIGHTENING BOLT "A" IS TWO-FOLD:
(1) PULLING CONCEALED FASTENER "B" FIRMLY DOWN ON THE BACK FLANGE OF PANEL "D", HOLDING IT SECURELY IN PLACE;
(2) PUTTING PANEL "D" UNDER TENSION IN THE DIRECTION INDICATED BY ARROW "F", MAKING "D" A STRAIN BEARING PANEL, SAME BEING ACCOMPLISHED BY ONE OF THE CONVEX SIDES OF FASTENER "B" ENGAGING THE TAPERED WEDGE LIKE SHAPE OF CHANNEL "C". THIS ACTION (AS FASTENER "B" IS BEING DRAWN DOWN) FORCES THE FASTENER OVER AGAINST PANEL "D"

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NOTE: WHEN OPERATION IS COMPLETED, BOLT "A" IS RELIEVED OF SIDE STRAINS AND IS THEN ONLY UNDER LENGTHWISE TENSION.

(SEE SKETCHES EEE FFF GGG)

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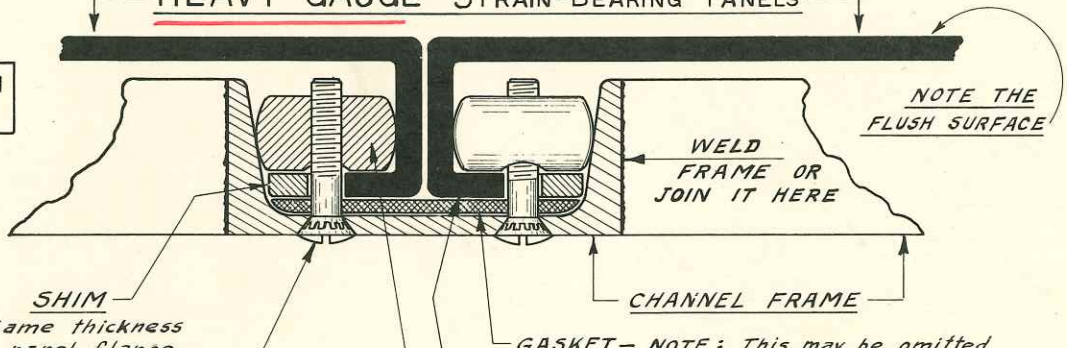
HEAVY GAUGE STRAIN-BEARING PANELS

SKETCH E E E


NOTE THE FLUSH SURFACE
WELD FRAME OR JOIN IT HERE
SHIM
Same thickness as panel flange
CHANNEL FRAME
GASKET — NOTE: This may be omitted when weather-tight joint is not required.
OVAL HEAD BOLT
WITH CUT S.A.E. THREADS & LOCK-WASHER UNDER HEAD
BACK FLANGES OF PANEL EXTEND ALONG ALL OF ITS EDGES. THEY ARE HELD SECURELY BY CONCEALED CONVEX RECTANGULAR PERMAGRIPS.

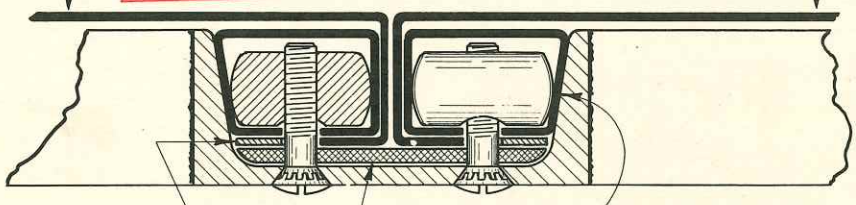
PANELS ARE PUT UNDER TENSION AS SHOWN IN SKETCH (D D D)

LIGHT GAUGE STRAIN-BEARING PANELS

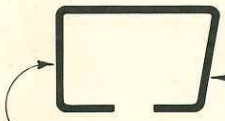
AS SHOWN IN SKETCH (DDD)

LIGHT GAUGE STRAIN-BEARING PANELS

SKETCH FFF



FOR DETAILS REFER TO SKETCH (EEE)
ALSO NOTE PARTICULARLY THE EXTRA FORMED INNER CHANNEL WHICH EQUALIZES THE TENSION ON THE OUTER PANEL.



SECTION OF INNER FORMED CHANNEL

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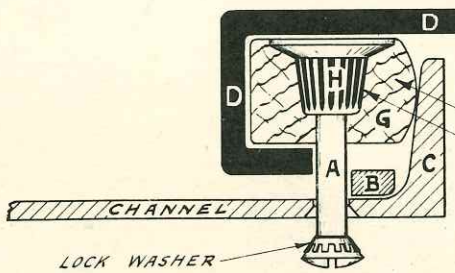
NOTE: WHEN REQUIRED FOR EXTRA HEAVY SERVICE, DIAGONAL STRAINS CAN BE PROVIDED FOR AS SHOWN IN SKETCH (GGG).

AN ALTERNATE METHOD

USING FULL LENGTH HARD WOOD CONVEX BACKING-STRIPS, AS CHANNEL ENGAGING AND PANEL TENSIONING MEANS.

— FOR LIGHT GAUGE AND HEAVY GAUGE METAL PANELS —



(A) BOLT (B) SHIM
(C) CHANNEL (D) METAL PANEL
(G) WOOD BACKING STRIP
(H) STANDARD CONCEALED RIBBED PERMAGRIP

NOTE: WHEN USING THIS ALTERNATE METHOD, OMIT METAL CONVEX PERMAGRIPS AND INNER FORMED CHANNELS.

SEE BACK PAGE

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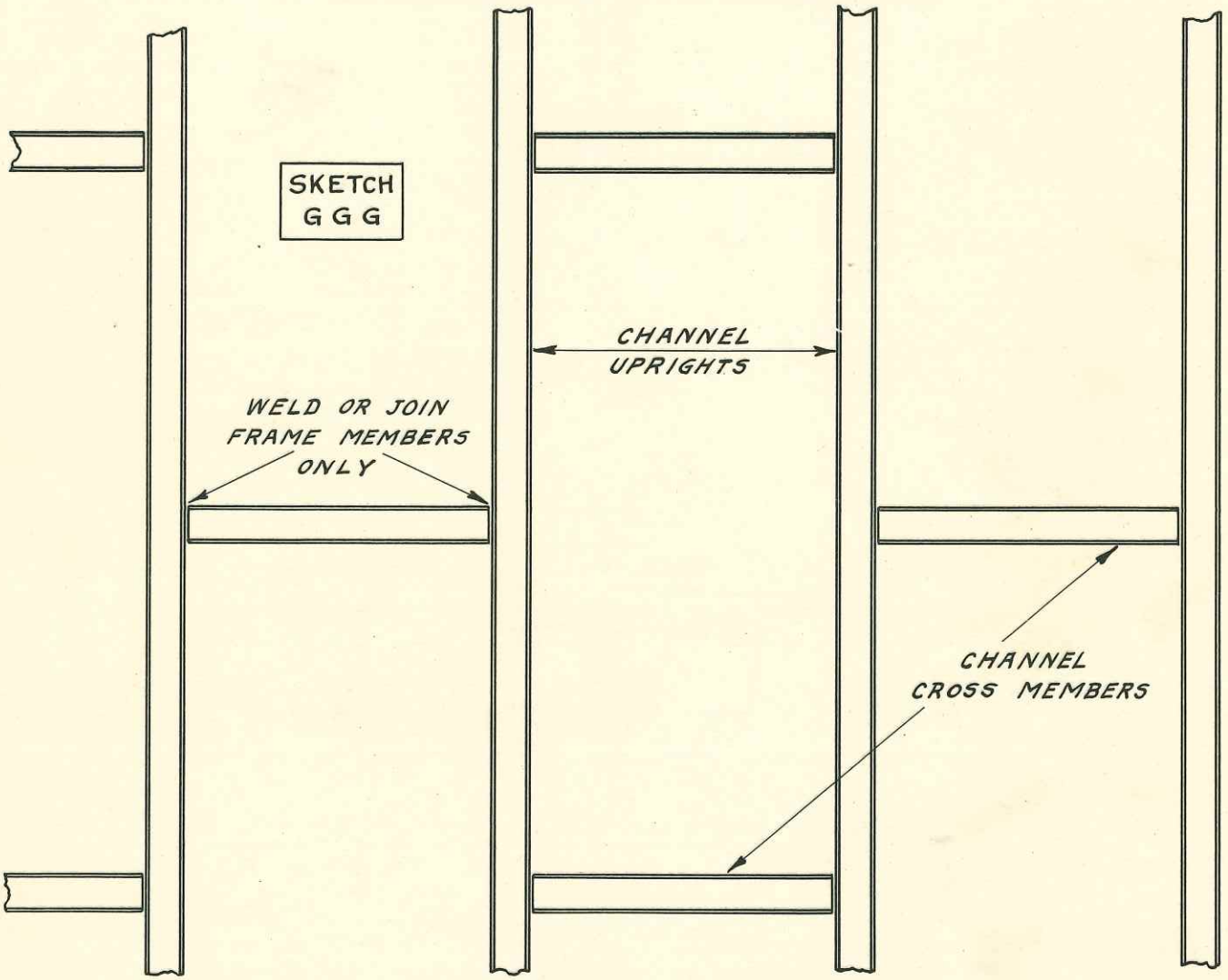
PLATE
(L)

ONE METHOD OF ARRANGING THE MAIN CHANNEL FRAME CONSTRUCTION TO PROVIDE FOR STRONG DIAGONAL BRACING THROUGH THE PANELS



NOTE: THE PANELS MAY BE "STAGGERED" TO PROVIDE ADDITIONAL STRONG DIAGONAL BRACING.

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(SEE ALSO SKETCHES DDD - EEE - FFF)

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PLATE (J)

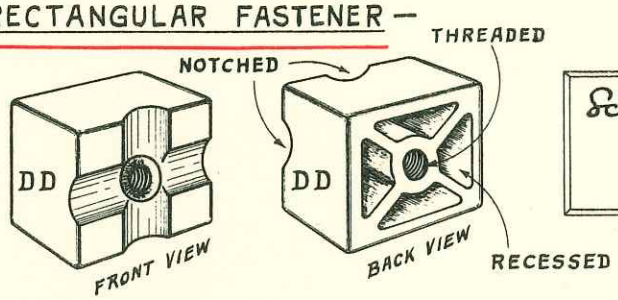
Schaefer Permagrip (special)

Concealed Fastening Methods

(PATENT APPLIED FOR)

Featuring one type used in ALL-METAL construction, where wood backing and wood backing-strips are omitted.
No counterboring nor branding required for rectangular type fasteners.
THREE METHODS OF INSTALLATION SHOWN:

— A RECTANGULAR FASTENER —



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CLEVELAND, OHIO
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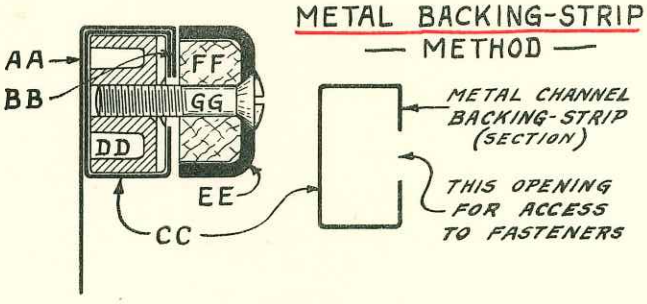
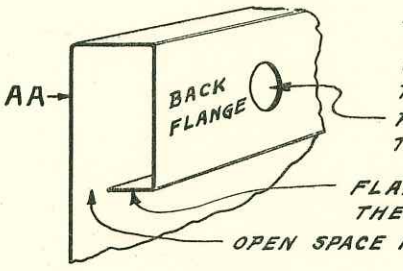
METAL BACKING-STRIP — METHOD —



AA	OUTER SHEET METAL PANEL
BB	BACK FLANGE OF PANEL
CC	FORMED CHANNEL BACKING STRIP
DD	RECTANGULAR PERMAGRIP FASTENER
EE	SECTION OF MAIN FRAME
FF	WOOD FILLER IN MAIN FRAME
GG	THREADED BOLT

— AN ALTERNATE METHOD —

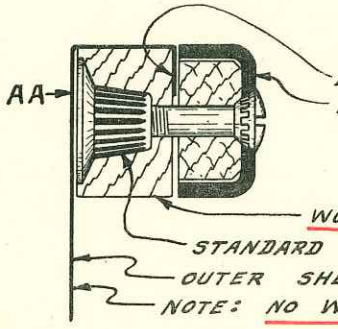


OMIT CHANNEL CC — BEND AND REBEND SHEET AA TO FORM CHANNEL FOR RECTANGULAR FASTENERS. PROVIDE HOLES IN BACK FLANGE FOR BOLTS GG TO ENGAGE CONCEALED FASTENERS DD.

FLANGE TO GUIDE DD FASTENERS AND TO PREVENT THEM FROM TURNING.

OPEN SPACE HERE PERMITS SHIFTING OF FASTENERS TO PROPER LOCATIONS

— SEMI STANDARD METHOD —



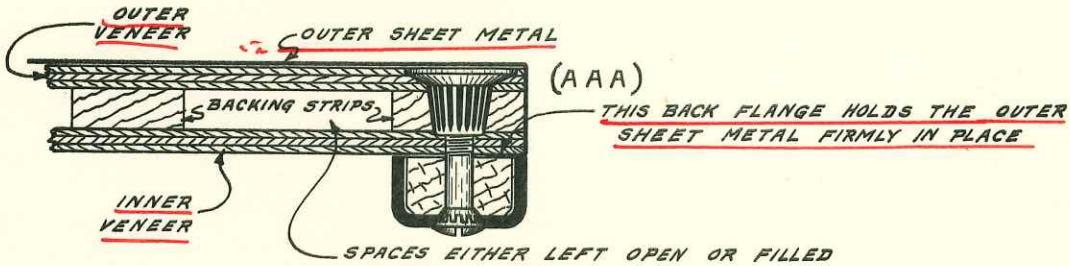
BACK FLANGE OF PANEL
MAIN FRAME WITH WOOD FILLER
WOOD BACKING STRIP
STANDARD RIBBED PERMAGRIP FASTENER
OUTER SHEET METAL
NOTE: NO WOOD BACKING HERE

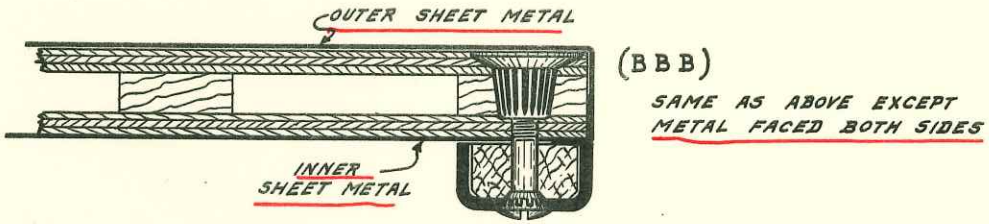
PLATE (K)

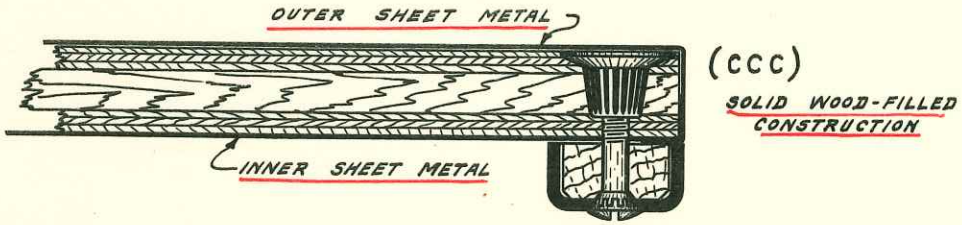
SOME SPECIAL CONSTRUCTION METHODS

Featuring Schaefer **PERMAGRIP** *Concealed Fasteners used in the manufacture of wood-backed smooth metal panels for various purposes in any desired wall thickness.*

— THREE SECTIONAL VIEWS: —


OUTER VENEER
OUTER SHEET METAL
(AAA)
BACKING STRIPS
THIS BACK FLANGE HOLDS THE OUTER SHEET METAL FIRMLY IN PLACE
INNER VENEER
SPACES EITHER LEFT OPEN OR FILLED WITH INSULATION MATERIAL





METAL-COVERED BOTH SIDES AND SOLID WOOD-FILLED
SIMILAR TO HIGH GRADE FIRE-DOOR CONSTRUCTION
(NOTE: MAY BE SOLID VENEER FILLER IF DESIRED)

—PATENT APPLIED FOR—

Schaefer **PERMAGRIP** Enterprises
CLEVELAND, OHIO U. S. A.

ERNEST SCHAEFER

Ernest Schaefer

CLEVELAND OHIO

Schaefer PERMAGRIP The New CONCEALED METHOD FOR Streamline CONSTRUCTION

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HIS PERMAGRIP products and methods are backed by many years of practical experience.

In the nationally famed custom motor body

pending for patents and trade mark registrations are to protect proper use of the ideas and devices.

"No structure is truly stream-lined unless free from exposed fastening devices"

SCHAEFER PERMAGRIP CONSTRUCTION IN MANY RESPECTS IS SIMILAR TO THE HUMAN BODY

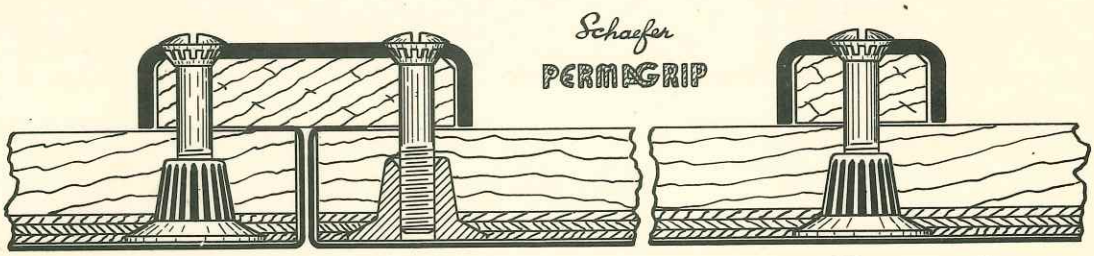
THE OUTER SURFACE:
(sheet-metal) - - (skin) is not subjected to

NOTE

Having seen drawings of various kinds of PERMAGRIP construction, the reader will profit by a careful study of the new ideas which are presented for his consideration throughout this book: The next page, for instance, features a "comparison" which applies particularly to the "Metal-Clad" (over wood, etc.) construction. The sketch at the foot of the page, drawings B,C,D,E, F,G,H,K, also some sheets of the typed text-matter belong to this class. Under this PERMAGRIP method the inner lining-material is made to serve two purposes: viz: as strain-bearing-member and as insulating-member. The outer sheet-metal covering in this case is practically free of strain. The numerous advantages of this novel construction merit careful consideration. E.S.

PERMAGRIP ADVANTAGES:

(a) makes practical individualized stream-lining possible (in any design - shape - or size) without requiring the usual expensive plant and die equipment;
(b) presents a smooth outer surface, entirely free from exposed mouldings - canvas fabric - outside bracing - etc.;
(c) entirely eliminates the usual "exposed" heads of bolts - rivets - screws - nails - etc.;
(d) assures unusual strength because each one of the PERMAGRIP FASTENERS (although concealed) is rated to resist a strain of 3400 pounds.



The New CONCEALED METHOD FOR MODERN Streamline CONSTRUCTION

NEGOTIATIONS FOR PATENT AND TRADE MARK REGISTRATION PENDING

Schaefer Permagrip Enterprises, Cleveland, O.

ERNEST SCHAEFER

HIS PERMAGRIP products and methods are backed by many years of practical experience.

In the nationally famed custom motor body shops of his father, Gustav Schaefer, at Cleveland, Ohio, he has had thorough training in every phase of the industry.

Since Permagrip products and methods are also needed in other fields they are being made available as *a service to all industry.*

The negotiations pending for patents and trade mark registrations are to protect proper use of the ideas and devices.

"No structure is truly stream-lined unless free from exposed fastening devices"

Ernest Schaefer

CLEVELAND OHIO

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SCHAEFER PERMAGRIP CONSTRUCTION IN MANY RESPECTS IS SIMILAR TO THE HUMAN BODY

THE OUTER SURFACE:
(sheet-metal) - - (skin) is not subjected to carrying strains;

THE FRAME STRUCTURE:
(welded steel) - - (bone) takes the violent strains - jolts - and shocks;

THE SEMI-ELASTIC ELEMENT:
(laminated ply-wood) - - (sinew and muscle) absorbs the constant normal vibrations;

THE CONCEALED RIGID BOND:
"inbuilt" beneath the surface in both cases and entirely concealed from view.

PERMAGRIP ADVANTAGES:

(a) makes practical individualized stream-lining possible (in any design - shape - or size) without requiring the usual expensive plant and die equipment;

(b) presents a smooth outer surface, entirely free from exposed mouldings - canvas fabric - outside bracing - etc.;

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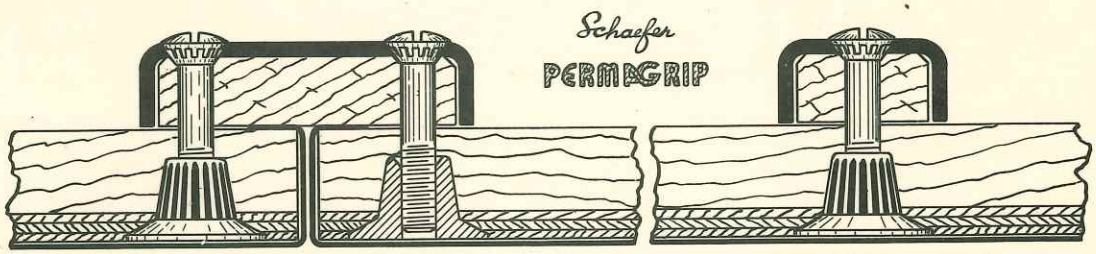

The New CONCEALED METHOD FOR MODERN Streamline CONSTRUCTION

NEGOTIATIONS FOR PATENT AND TRADE MARK REGISTRATION PENDING

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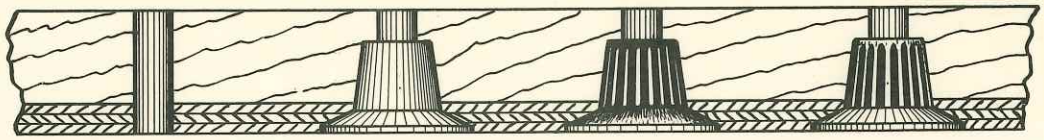
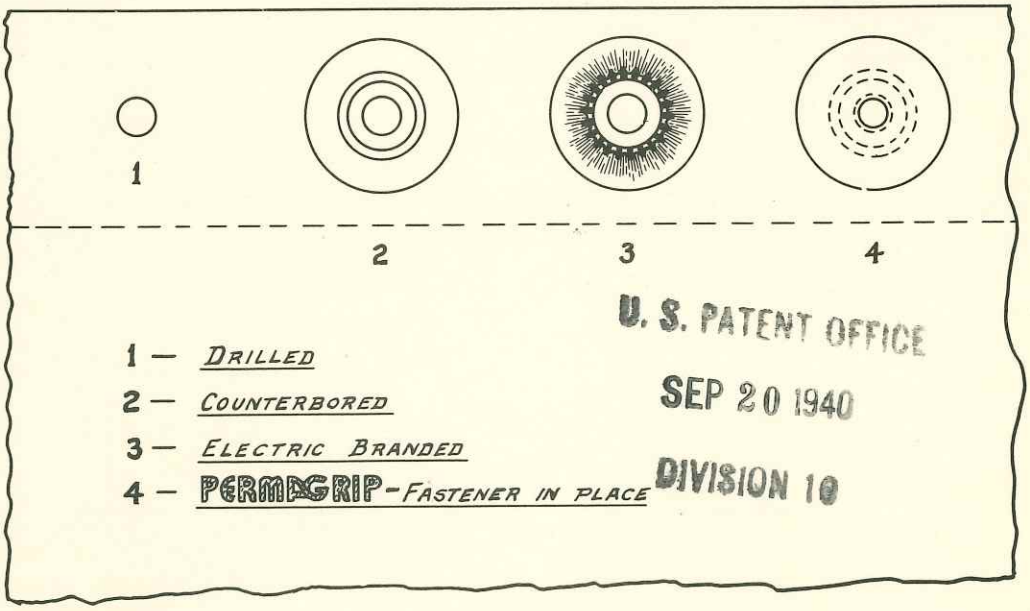
(B)



CROSS SECTION

Schaefer
Concealed
PERMAGRIP
(rated at 3400 lbs. pulling strain)



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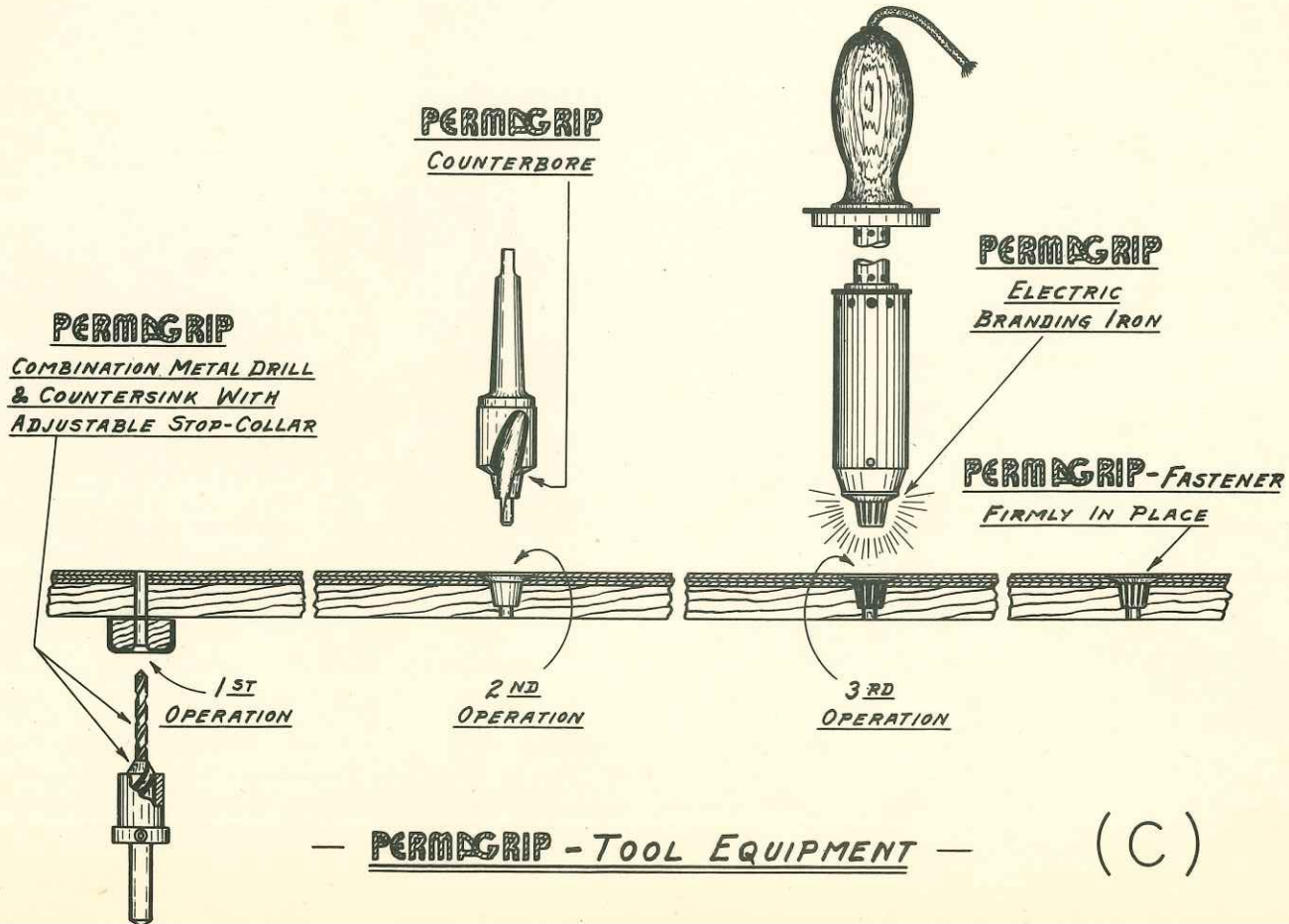
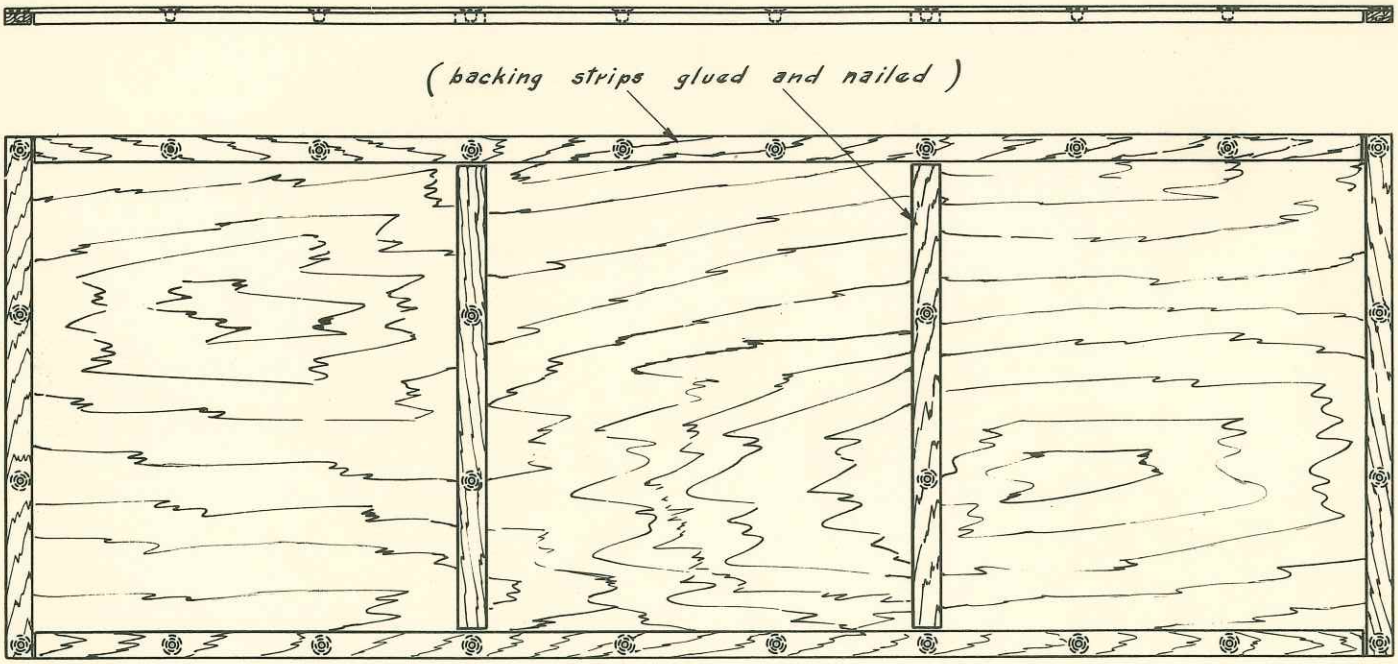
PERMAGRIP INSTALLATION OPERATIONS



— PERMAGRIP - TOOL EQUIPMENT —

(C)



PERMAGRIP LAMINATED PLYWOOD PANEL (interior view)

— backing strips attached —

ready for PERMAGRIP-FASTENERS and outer sheet-metal covering

(D)

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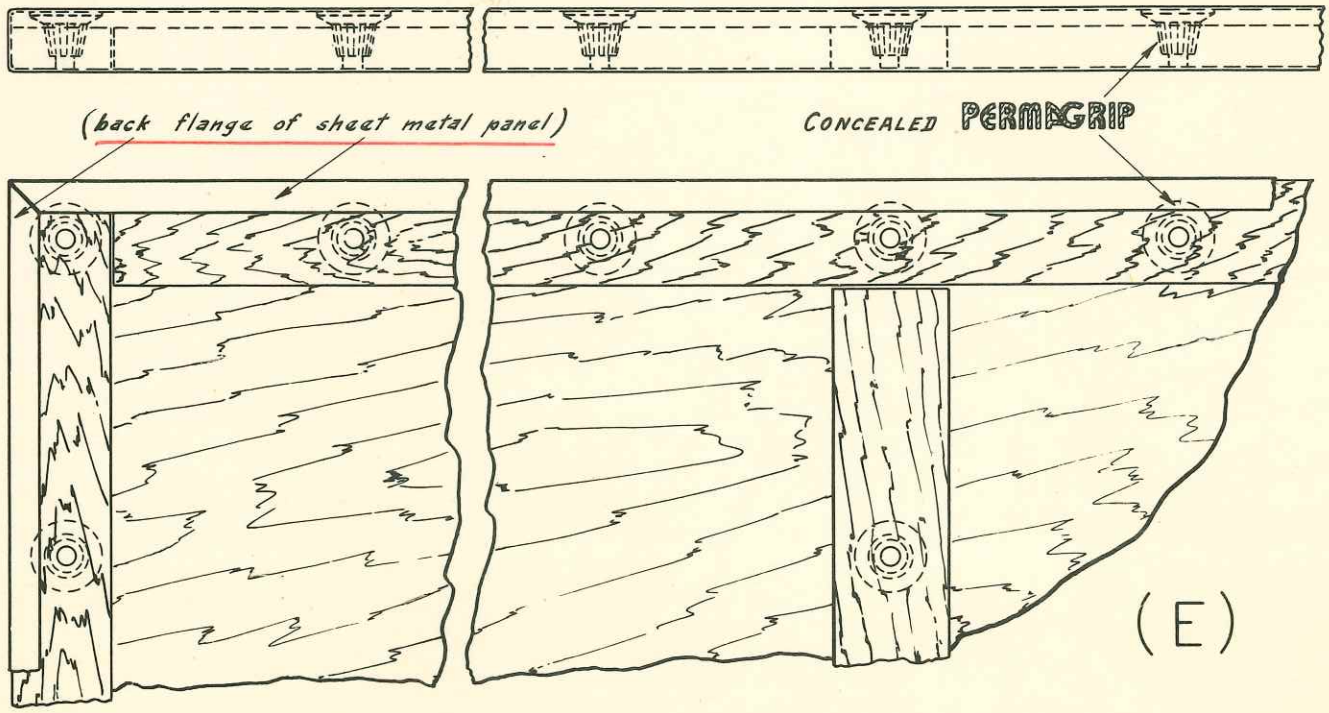

(E)

PERMAGRIP PANEL ASSEMBLY

(corner section – interior view)

Sheet metal in place

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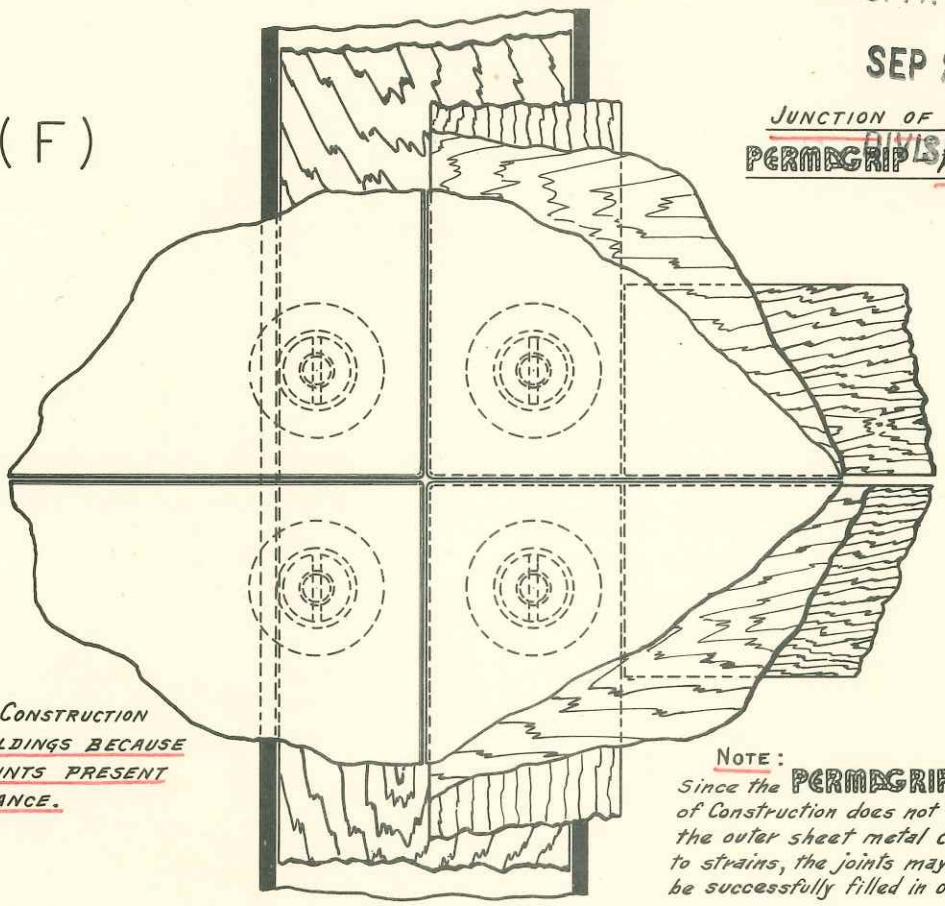
(F)

JUNCTION OF FOUR PERMAGRIP PANELS

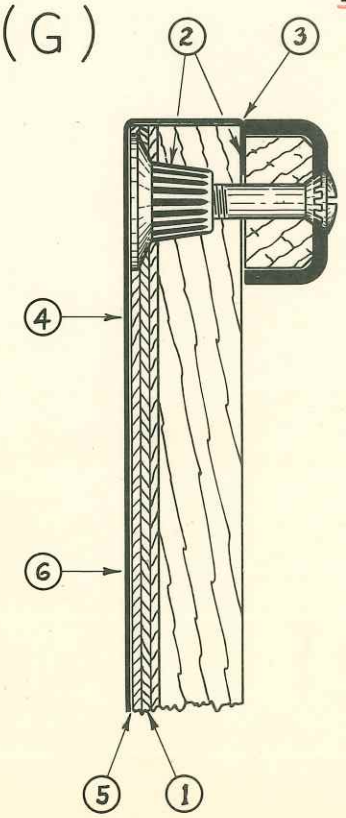


PERMAGRIP - CONSTRUCTION REQUIRES NO MOULDINGS BECAUSE THE BUTTED JOINTS PRESENT A NEAT APPEARANCE.

NOTE: Since the PERMAGRIP-Method of Construction does not subject the outer sheet metal covering to strains, the joints may (if desired) be successfully filled in or soldered.

PERMAGRIP - CONSTRUCTION FEATURES

(G)



NOTE:

1. Advantages of Plywood in PERMAGRIP Construction
   (a) Takes all normal strains + vibrations
   (b) Transmits the hard jolts to the main framework
   (c) Provides a strong backing for the outer sheet-metal covering
   (d) Acts as an insulating agent against heat + cold, and rumbling noise
2. Separate anchorage of plywood panel and the outer sheet-metal covering permits each (according to its nature) to expand or contract independently with weather conditions
3. All around the edges of the PERMAGRIP Panel the back sheet-metal flange is held tightly against the frame
4. Conforms to the demands of Modern Streamline Construction; the outer sheet-metal covering is free of holes — it has no bolts, nuts, rivets, screws, nails, or other exposed means of fastening — the concealed PERMAGRIP holds everything firmly in place
5. Plain steel armor plate without any holes and without additional means of fastening may be inserted here and entirely concealed — sheet asbestos insulation, or any other similar material may be inserted in like manner
6. Since the outer sheet-metal covering is not subjected to strain, metals other than ordinary steel may be substituted to meet special conditions — such metals include stainless steel, aluminum, monel metal, tin, brass, copper, zinc, thin tellurium process lead, etc.

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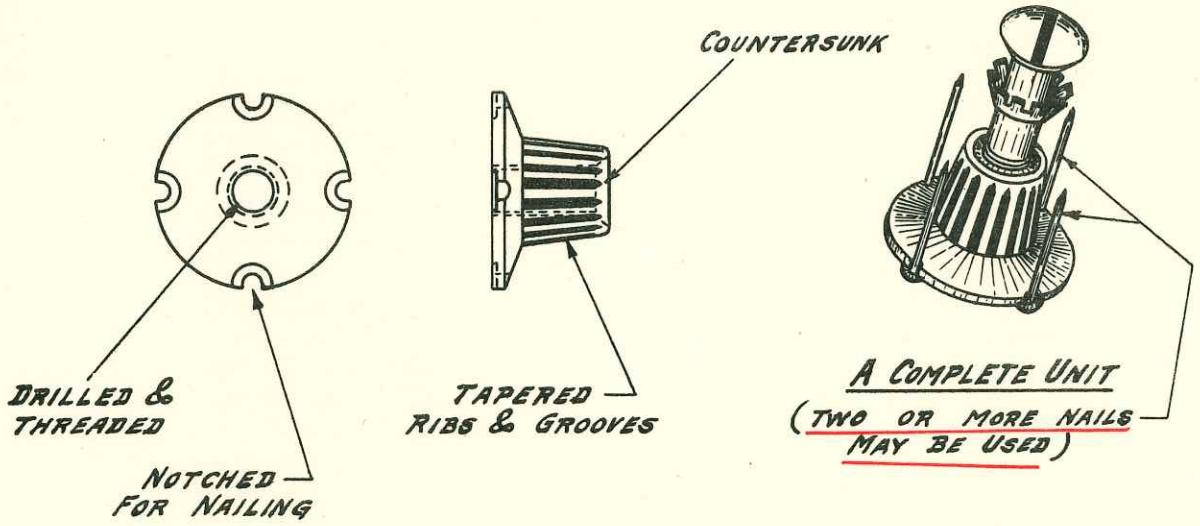
PLATE (H)

Schaefer PERMAGRIP
NAILING TYPE
CONCEALED FASTENER
— PATENT APPLIED FOR —

NOTE: *These fasteners may feature either the usual side ribs, or the ribs may be omitted if desired. Very handy for certain types of installations. Provides a sure and simple method of keeping fasteners in place during process of panel assembling.*



Schaefer PERMAGRIP Enterprises
CLEVELAND, OHIO U.S.A.

PERMAGRIP
THE NEW "CONCEALED" FASTENER
THE NEW "STREAM LINE" CONSTRUCTION-METHOD
A DETAILED DESCRIPTION
(SEE ALSO DRAWINGS)

CONCEALED PERMAGRIP A SECURE FASTENER

PERMAGRIP as its name implies, is a new simple device and a new practical method for firmly attaching wall panels, roof panels, etc., to an inner frame-work. One of its novel features is the manner in which it is entirely concealed from view. It lends itself admirably to modern stream-lining which demands an unobstructed outer surface. Due to its great strength (3400 pounds per unit rating) relatively few of the fasteners are required to hold the panels securely in place. The wood backing-strip in which PERMAGRIP is imbedded acts as a bridge from one fastener to the next. A powerful wrench type screw-driver is all that's needed to draw the bolts up surprisingly tight from within. The oval head of the SAE "cut thread" bolt and the PERMAGRIP socket are both tapered and thus have the effect of two opposed wedges forced together. The lock-washer under the head of the bolt is merely an extra precaution against the effects of vibration, and it can therefore be entirely omitted when making stationary objects. Note: - On certain installations it may be found satisfactory to use square or hex head bolts instead of the strong oval head slotted bolts.

WELDED STEEL INNER FRAME WORK

Since the requirements of various industries differ, some may prefer to use a wood frame or metal angles. For the purpose of illustrating, one method used in building transportation-equipment is described herewith: - Having decided on the style, design, and size of body to be built, "U" shaped bows are made of light steel channel. Each unit comprising both side-posts and the roof supporting bow is formed from one single bar of the material. The "forming" is done "cold" over hand operated bending-dies. With the inverted "U" shaped members in place, longitudinal frame-members of similar channel are then installed back-to-back against the uprights and welded to same. The welding of the inner frame may be done either before or after the panels are installed. The absence of all "notching" leaves the material full-strength and therefore provides a strong inner Body-Frame that will stand the hard jolts. The intermediate channels are of narrow width, while the channels placed at panel-joints are of double width. Drilling and countersinking of frame to suit the fasteners is the next operation. Note: - In quantity production the drilling may be done before the frame members are formed.

EVEN SINGLE UNITS CAN BE OF MODERN PLEASING DESIGN

The simple PERMAGRIP METHOD makes it possible to build even single units, or a relatively small number of units to individual requirements, and in the modern pleasing styles now found only in the so called "mass production" units, but without the expensive plant-equipment required in "mass production."

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SOLVING AN OLD PROBLEM

Those who are familiar with the history of the Automotive Industry will remember the drastic changes that quick process Lacquer Spray Painting brought with it. They will recall that the new product could not be used satisfactorily on the wood bodies then in vogue, and that the commercial custom body builder in particular, was suddenly confronted with the necessity of devising ways and means to cover the outer surface with metal. That most attempts along this line have so far been more or less crude, is well known by all. Canvas tops, exposed mouldings, exposed bracing, and exposed fastenings are altogether too much in evidence to be overlooked. Note how PERMAGRIP solves this old problem.

PERMAGRIP IS A BIG STEP FORWARD

Motor Truck Manufacturers have long ago recognized the necessity of stream-lining their chasses and even the cheapest of them are beautiful. The beauty, however, extends only from the front bumper to the rear cab wall. BUT from that point back, they still have only a straight frame with a pair of rear wheels. The commercial custom body in too many cases is merely a more or less "glorified" packing-case and in appearance is not in harmony and keeping with the beauty of the front end of the truck. A similar situation prevails in the railroad and street car field. Builders welcome PERMAGRIP because it makes Modern Construction possible in either limited or multiple production - and, besides in a strong, practical and simple way.

FINER METALS MADE MORE BEAUTIFUL

Sheet-metal industries working in the finer and more expensive metals are still disfiguring the outer surface with holes pierced through for exposed fasteners. PERMAGRIP brings relief from this old unsightly practice. PERMAGRIP makes it possible to obtain maximum beauty in the use of the finer metals.

LIMITATIONS OF "ALL STEEL"

The public has been told much about "all steel" construction and its designers have made big strides and developed definite markets for their products - however, in the transportation field it has equally definite limitations which are recognized by those who know. Even the finest so called "all steel" stream-lined trains are backed with WOOD which provides insulation against heat and cold, and at the same time helps to reduce rumbling noise. The "built up" heat in many an "all steel" railroad car, motor truck, and trailer has ruined the fine finish on costly furniture in transit. Other products also suffer damage from extremes in heat and cold. Under the PERMAGRIP METHOD the Plywood serves both as "insulation" and as "load-carrying member."

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STRENGTH AND RESILIENCE OF PLYWOOD SERVES DOUBLE PURPOSE

PERMAGRIP can be used in a variety of ways to suit individual requirements. While it usually features the Plywood as The Normal Strain Bearing Member that transmits the hard jolts to the inner steel frame, it may in some cases be found desirable to substitute other types of manufactured board, or even plastics on the curved sections. On certain other installations the "backing" may be omitted entirely and merely a built-up wood frame of backing-strips used to imbed the fasteners and to hold the metal panel in place. For general work, however, Plywood with its laminated structure is hard to match for strength and resilience (weight and bulk considered). The difficulty in the past has been to find a way to "hold" Plywood so that the fibers would not crush and the rivets "pull through" under strain and vibration. Examine the drawings and note how the large double tapered surface of the PERMAGRIP socket accomplishes the desired effect. - It should be borne in mind here that Plywood under the PERMAGRIP METHOD performs several desirable services: (a) Carries the load and relieves the outer sheet-metal of carrying-strains; (b) protects outer metal panel against damage from within; (c) insulates against heat and cold, and reduces rumbling noise.

OUTER SHEET-METAL IS RELIEVED OF STRAIN NOVEL WAY OF ATTACHMENT OPENS UP NEW FIELDS FOR NON-RUSTING METALS

While Auto Body Steel will no doubt always be the most useful material for the outer surface, especially since in the past it has best withstood the tendency of holes to elongate under vibration and strain, PERMAGRIP opens up new fields here as well. For instance, along the seaboard where the brine in the atmosphere is the ruination of steel, other softer, non-rusting materials can now be used for the outer panels BECAUSE there are no holes to contend with, and the metal is not required to carry any load or strain other than its own weight and that of the paint applied to it. At no point along the outer face is the sheet-metal pierced with holes, nor is it held anywhere along its outer surface. Those who have seen how one man can bring a boat to a "Stop" by winding a rope around the "snubbing post" at the dock will understand the rigidity with which the back "flange" of the sheet-metal is "pinched" or "held" against the main frame-work.

UNRESTRICTED EXPANSION AND CONTRACTION

Separate anchorage of the outer metal surface (held separately by its back flange,) and of the Plywood (held separately by the concealed PERMAGRIP) works WITH nature in that it permits the wood and the metal to swell and to shrink (in their opposed manner,) independently of each other - and without harm.

SAVES TIME ON REPAIRS

A fleet-owner may keep a complete set of panels on hand, all painted and ready for use. One or more damaged panels may be easily replaced between "trips" and the equipment thus kept in service.

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DESIRABLE FOR EXPORT SAVES ON OCEAN-FREIGHT

The PERMAGRIP CONSTRUCTION METHOD features four valuable export possibilities: (a) to build a structure complete at the factory; (b) to take it apart again; (c) to pack it in a small space (often in waste space) thus reducing the bulk of the shipment to a small number of cubic feet and effecting a great saving in Ocean Freight; (d) a definite, simple and practical way to re-assemble the structure at destination - four important advantages which merit careful consideration.

NEW WAY TO INSTALL ARMOR-PLATE AND SHEET-INSULATION MATERIALS

The race between the makers of steel armor and the makers of bullets is as old as the story of "gunpowder." No sooner has the one perfected HIS product than the OTHER goes back to his laboratory and produces a new product that thwarts the other. The difficulty of working armor-plate has resulted in making armored units as a rule clumsy, and because of exposed rivets "unattractive." It is obvious that an armor-plate that can be drilled (for insertion of rivets) can also be pierced with bullets. By the use of "harder" and "concealed" armor-plate, PERMAGRIP offers extra protection and better appearance. This is made possible only BECAUSE this new method requires NO DRILLING of holes and no extra means of fastening, the flat armor-plates are "inserted" between the Plywood backing and the outer sheet-metal covering. -- In transporting perishable goods extra sheet-insulation material is often found desirable; it can be "inserted" in like manner.

PERMAGRIP SUMMARIZED

Completely fulfils the demands of modern stream lining.

Simple - practical - adapted to limited and multiple production.

Produces sleek unobstructed outer surface.

Provides unusual strength.

Fasteners entirely concealed from view.

Usual holes for exposed fasteners eliminated.

No holes to elongate through strain and vibration.

Laminated Ply Wood serves double purpose:
Carries load strain - insulates against heat and cold. Reduces rumble noise.

No load carried by outer metal panels.

Works WITH nature - provides for unrestricted expansion and contraction.

Opens new fields for non-rusting metals.

Speeds up repairs - cuts out delays.

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PERMAGRIP SUMMARIZED (Continued)

Indispensable in export trade.

Better appearance - added protection on armored units.

Extra insulation easily inserted.

PERMAGRIP Devices - PERMAGRIP Construction Methods - PERMAGRIP Special Simple Tool Equipment - are Ready to Serve all Industry.

The inventor offers PERMAGRIP confident that it is decidedly practical - an absolute necessity in modern stream lining - a new idea of merit bound to benefit all concerned.

Determine how PERMAGRIP can BEST SERVE YOU.

Correspondence invited.

Sincerely,

Ernest Schaefer

Ernest Schaefer,
SCHAEFER PERMAGRIP ENTERPRISES
CLEVELAND, OHIO.

P. S. Study detailed drawings. See reprint March 1st magazine "Steel." Note special stream-lined truck (a PERMAGRIP product). This traveling mining-laboratory is the only unit of its kind in the world. After nearly a year in the hot desert, E. A. Moross, its owner, addressed the inventor of PERMAGRIP as "World's Premier Truck Body Designer."- -E. S.

U. S. PATENT OFFICE
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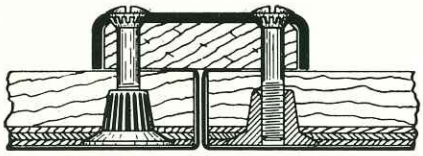
STREAMLINED custom built bodies for commercial vehicles similar to the one on this traveling laboratory are built through the use of the new combination wood and metal construction. Seams are visible in the side of the body, while those on the roof have been filled in

New Construction Process Eliminates Visible Joints, Bolts and Rivets

STREAMLINED metal surfaces free from bolts, rivets and similar projections are built through the use of a new fastening method devised by Ernest Schaefer, Cleveland. Since the use of heavy dies and presses is not needed in this process, it lends itself to the construction of custom built bodies for trucks and other commercial vehicles, streamlined trains and building fronts where mass production is neither necessary nor desirable and many other products.

Bolt Is Main Feature

Main feature of the new construction, which is known as Permagrip, is a special bolt which holds a thin sheet of metal over a backing of plywood. In construction by this new method, panels are built from plywood and wood backing strips. Holes to fit the special ribbed and flanged nut are bored and countersunk and then branded to exact size by a special electric branding iron designed by Mr. Schaefer. After the nuts are inserted in these holes, the outside is covered with metal sheet which is rolled over the edges. The completed panel is then applied to the frame and pulled tight by bolts which are inserted in holes countersunk in the steel frame. The ribbing on the nuts prevents them from turning as the bolts are tightened. Edges of the metal sheets are clamped between the backing strips and wood pieces inserted in the U-shaped members of the welded steel frame, as shown in the accompanying diagram. Absence of metal-to-metal contact which results from this feature, minimizes transmission of noise. Completed panels are butted tightly together to make a neat joint, which may be filled in with solder or similar material if a continuous unbroken surface is desired.



CROSS section diagram of the method of construction. The outer metal sheet shown by the heavy black line is clamped between backing strips and wood strips inserted in the U-shaped members of the welded steel frame and held by pressure of the special hidden bolt. Absence of metal-to-metal contact minimizes noise

The special bolts used have been designed by the inventor to withstand a pull of 3400 pounds. Outer metal sheathing may be of any desired thickness, limited only by the fact that it must take a 90-degree bend. Since the metal itself is not subject to strain, any type of ferrous or nonferrous metal may be used. Buckling or waving due to unequal thermal coefficients of expansion between the metal and the plywood backing is eliminated since there is no rigid attachment between the two surfaces.

An additional feature of this type construction, according to the inventor, is that armor plate may be inserted between the metal sheeting and the plywood if protection is desired, and the same holds true for sheet insulation against heat or noise. A set of tools, including drills, countersinks, counterbores and the electric branding iron, has been designed by the inventor for rapid and efficient use of the new construction method.

Reprinted from **STEEL**, *Cleveland, March* 1, 1937

for

Ernest Schaefer, inventor of PERMAGRIP, the new concealed method for modern streamline construction,

Schaefer Permagrip Enterprises,
~~20627 Lorain Avenue~~ *Cleveland, Ohio.*

Concealed Fasteners

U. S. PATENT OFFICE
SEP 20 1940
DIVISION 19

Special fastener units permit wide flexibility in design of streamlined truck bodies and similar structures. Eliminate bolt, rivet, screw heads. Joints invisible

■ THE DEMAND for sleek, smooth, modern streamlining in the commercial truck body industry resulted in development of a fastening method which employs strong concealed Permagrip fasteners to relieve the outer metal surface of nuts, heads or bolts, rivets, screws or nails. These fasteners also eliminate joint moldings and the like. The Permagrip system is a development of Ernest Schaefer, Cleveland.

The Permagrip method has a number of advantages which makes it suitable not only for auto body construction but also makes it extremely useful in assembling steel and wood panel structures in such items as store fronts, walls, ceilings, partitions, elevator enclosures, metal roofs, portable garages, factory-built homes, baked enamel structures of all types, counters, cabinets, bar fixtures, office equipment, armored booths, refrigerator or heater units, signs, bulletin boards, etc.

First described in STEEL, March 1, 1937, several developments of significance have been made in this system recently. The Permagrip method features use of a special flanged flush-mounting nut which fits into a specially prepared hole in the outer surface of the structure. As will be noted, Fig. 5, the outer surface of the structure is smooth with no evidence of the bolts. One method, Fig. 1, of applying the Permagrip fasteners consists in preparing the hole, placing the fastener in position and then laying over this the outer metal sheet which is folded around the edge of the wooden panel at the joint entirely concealing the Permagrip fastener.

Advantages of such a system are that it makes practical individual streamlining in any design, shape or size of structure without requiring expensive plant forming and die equipment. A smooth outer surface entirely free from exposed moldings, canvas fabric, outside bracing and similar obstructions is produced. In addition, joints can be filled with solder to present an unbroken surface. It completely eliminates the usual exposed heads of bolts, rivets, screws and nails. It assures unusual strength because each Permagrip fastener, although concealed, is rated to resist a strain of 3400 pounds. Used with sheet metal and laminated wood panels, a wide variety of structures is easily built with perfect streamlined surfaces.

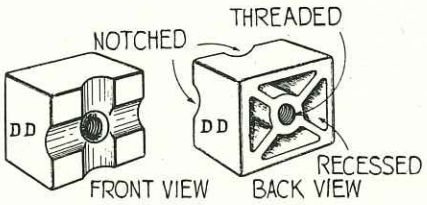


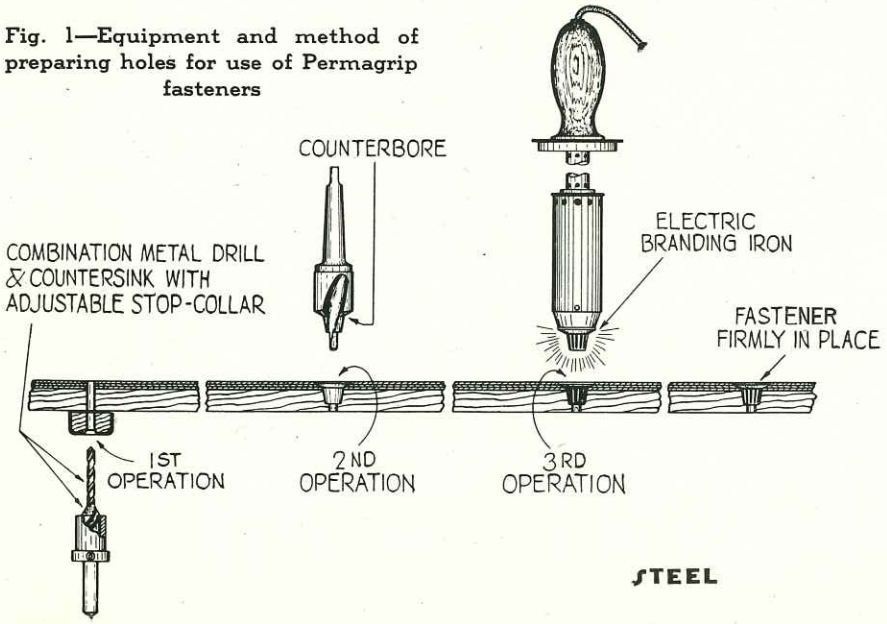
Fig. 2—Rectangular type fastener

Additional advantages include the fact there are no holes in the outer metal surface to elongate through strain or vibration. Laminated plywood construction serves a double purpose. It carries load strain, insulates against heat and cold and reduces rumble noise. No load is carried by the outer metal panels. Such a construction permits unrestricted expansion and contraction of wood and metal independently, permits use of nonrusting metals, speeds up repairs and reduces original fabricating time. In addition, extra insulation can easily be inserted where desired.

Fig. 1 illustrates the procedure for applying these fasteners. First operation is a combination metal drill and countersink with adjustable stop collar which drills a hole through the joining rib and outer sheath. Second operation is to counterbore from the outside surface of the wood panel to prepare it to receive the fastener. This is done with a special counterbore which produces a hole of the required contour.

Third operation consists of branding the hole with an electric branding iron which forms the grooves

Fig. 1—Equipment and method of preparing holes for use of Permagrip fasteners



in the hole. These grooves fit the ribs in the tapered body of the fastener when it is inserted in the hole and thus keep the fastener from turning.

Common method of construction is where outer panels are joined together by bolting through to a welded steel bridging bar which forms the framework for the structure, the bar bridging over the joint between the two outer sections. Many variations have been developed to meet particular applications. New types of Permagrip fastenings are of particular interest.

At the right in Fig. 5 is the nailing type which contains four notches on the outer circumference for use with two or more nails to locate firmly the Permagrip fastener in the plywood panels. This provides a simple method of keeping the fasteners securely in place during process of assembling the panels.

All-Metal Construction

Fig. 2 shows another recent development featuring a type useful in all-metal construction where wood backing for the metal panels and wood backing strips at joints are completely eliminated. No counterboring or branding is required when using this rectangular type fastener and the construction produced is entirely of metal. Figs. 3 and 4 show methods of using the rectangular type fastener. In Fig. 3 a metal backing strip is employed in connection with a metal panel which holds the rectangular fasteners. In such assemblies the outer sheet is gripped around the edges in the standard method, using wood backing.

In Fig. 4 an alternate method is indicated where the channel CC in Fig. 3 is omitted and sheet AA is simply bent and rebent to form a channel which receives the rectangular fastener. In this case, of course, holes must be provided at back of the flange for bolts to engage the concealed fastener. It will be noted in this method the rebent

Fig. 3—Metal backing strip method of construction using the rectangular fastener

flange is not closed entirely, an open space being retained at the bottom to permit shifting the fasteners to their proper location.

Use of these fasteners permits

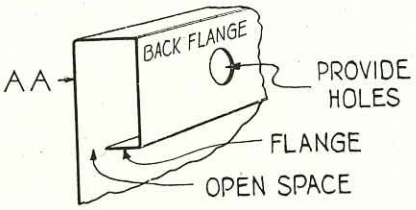
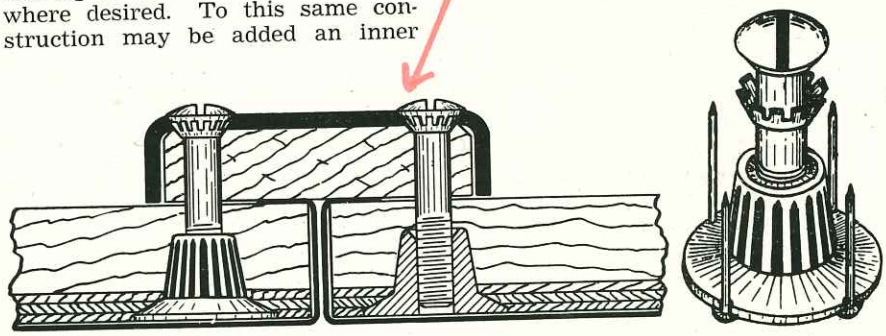


Fig. 4—An alternate method of using the rectangular fastener. This eliminates the metal backing strip CC used in Fig. 3

wide variation in type of construction. For instance the wall or panels may consist of an outer metal sheet over a plywood panel with backing strip separating this panel from a second inner plywood panel making a double wall construction where desired. To this same construction may be added an inner sheet of metal where both outer and inner surfaces of metal may be desired. Similarly a solid wood construction may be used in place of strips between the inner and outer plywood panel. Likewise this system is readily adapted to making walls of extremely high insulating value by incorporating various types of insulation between the inner and outer plywood panels.

In one case, special bulletproof bodies have been constructed by including an armor sheath in the wall construction. Similar variations appear to be possible without limit. Where desired, the joints between outer sheets may be filled in with solder and subsequently ground smooth to furnish a perfectly smooth surface with no visible joints. Since the outer sheet of metal is not subjected to strains, the joints themselves are not stressed so the solder will not pull apart.

Fig. 5—At left is shown method of using Permagrip fasteners to join panels using a bridging bar across back of joint. At right is the special nailing type fastener



U. S. PATENT OFFICE
SEP 20 1940
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Reprinted from **STEEL**, *February* 20, 1939

for

Ernest Schaefer, inventor of PERMAGRIP, the new concealed method for modern streamline construction,

Schaefer Permagrip Enterprises,

~~20627 Lorain Avenue~~ *Cleveland, Ohio.*

Reprinted from STEEL, February 26, 1940

Strain-Bearing Panel System

U. S. PATENT OFFICE
SEP 20 1940
DIVISION 16

New method of making stressed-skin structures has tension applied by wedge action as parts are tightened during assembly. System applicable to auto, truck and railroad car bodies as well as others

By ERNEST SCHAEFER
Schaefer Permagrip Enterprises
4176 West 208th Street
Cleveland

■ THE Permagrip fastening method already has been utilized for all-wood and for metal-clad wood construction of automobile bodies and other units in which the outer metal covering is practically strain-free. Now the method has been extended by newly designed devices which permit the tensile strength of the outer metal panels to be utilized to carry part of the structural stresses. See STEEL, Feb. 20, 1939, p. 44, for details of the non-strain-bearing types of Permagrip construction.

Purpose of using strain-bearing panel construction is to permit the heavy-gage steel sheets forming the outer surfaces to take part of the structural loads of the body, etc., through tension. Used with welded frame channel and angle iron, such a construction provides an extremely rigid and substantial body which can be adapted easily to many types of special automobiles, trucks and other equipment to form a smooth, flush, streamlined outer surface. Also it is suitable for railroad cars, airplanes, tanks, etc. This construction may even be used to advantage in making boilers and similar equipment because absence of holes in the shell makes full tensile strength of the material available.

In attaching armor plate it is especially advantageous. No holes through the armor are necessary, thus no allowance need be made for drilling or punching the material so the plate can be treated to give any desired degree of hardness, resulting in maximum protection.

Fig. 1 shows how the Permagrip fastening method is adapted to form strain-bearing panels. In this illustration, A is the bolt. With a lock washer, it is placed through the channel from the inside of the body and draws down the Permagrip fastener B against the sloping inside wall of channel C, thus pulling outer panel D slightly to the left and placing it under tension so that its tensile strength can be utilized effectively to increase the strength of the body. In Fig. 1, E is a metal shim placed under fastener B, opposite the back flanged edge of panel D, to equalize pressure as fastener B is screwed down tight.

Thus the effect of tightening bolt A is twofold. It pulls the concealed fastener B firmly down on the back flange of panel D, holding it securely in place. At the same time, it places panel D under tension in the direction indicated by arrow F, making D a strain-bearing panel. This latter is accomplished by one of the convex sides of fastener B engaging the tapered wedge-like shape of channel C as it is drawn into position. When the operation is com-

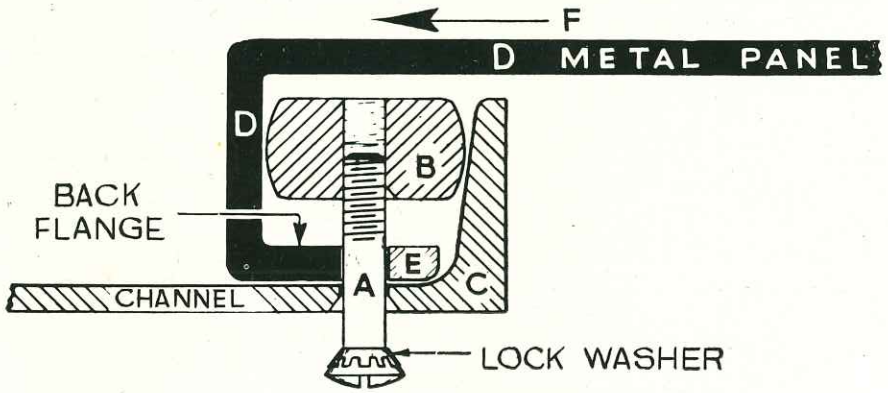


Fig. 1. (Top)—Permagrip tension method is outlined here. Arrows indicate points where tension is developed as bolt A draws fastener B into position during assembly. D is metal panel with C portion of channel, the sloping inner surface of which develops the wedge action

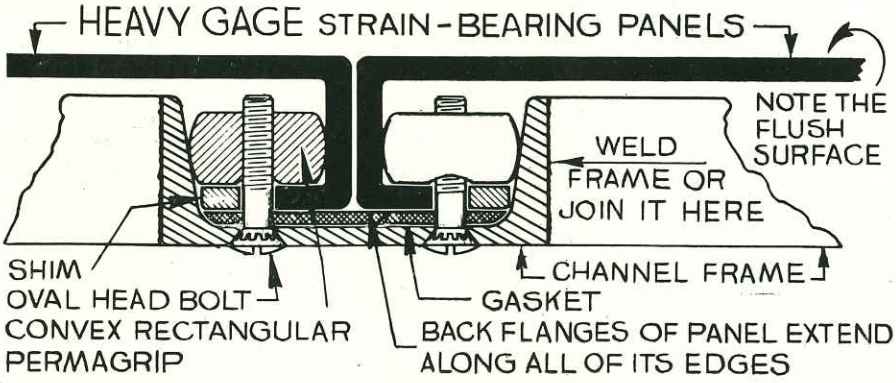


Fig. 2. (Center)—Diagram illustrates how smooth flush outside joints are made with heavy-gage outer panels. Concealed rectangular Permagrips are employed

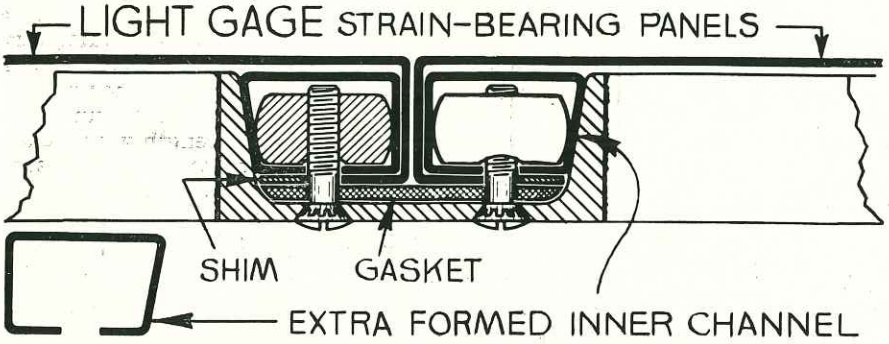


Fig. 3. (Bottom)—For light-gage panels, an extra formed inner channel is used as shown here to equalize tension on outer panels

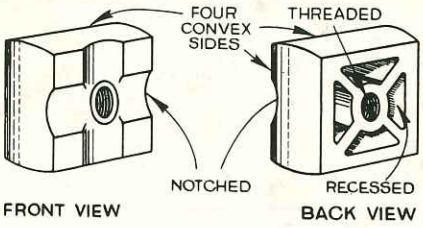


Fig. 4—The four convex outer sides of the Permagrip fasteners are essential features of the strain-bearing assembly diagrammed in Figs. 1, 2 and 3

pleted, bolt A is relieved of side strains and is only under lengthwise tension.

While Fig. 2 shows application of the all-steel strain-bearing construction to heavy-gage panels, Fig. 3 shows how light-gage panels are utilized as strain-bearing sections also. In this latter example, Fig. 3, an extra formed inner channel is employed to equalize the tension on the outer panel and to re-enforce the flanged outer panel. Except for the use of this formed inner channel, the construction and operation of parts are identical with those for the heavy-gage panels shown in Fig. 2. It will be noted that the shim in this case is much thinner as it must, of course, match thickness of the panel to provide equalized bearing of the fastener against the channel and gasket. In both constructions, a gasket is employed immediately adjacent to the channel to make the joint weathertight. Where a weathertight joint is not required, this gasket may be omitted.

The extra formed inner channel used with light-gage panels usually is made of the same material as the panels themselves.

Where extra-heavy service is encountered and maximum strength is to be provided, a method similar to that shown in Fig. 5 may be employed to advantage. Here the main channels of the framework are staggered or alternated, as shown, to provide for strong diagonal bracing through the panels themselves. Of course the panels are staggered so the edges coincide with the channels to provide maximum strength.

Fig. 5. (Upper)—This method of arranging channels in the frame permits staggering of panels thus developing maximum strength from the diagonal bracing afforded by tensioned panels

Fig. 6. (Lower)—Here is an alternate method of making strain-bearing panel assemblies. It is not all-metal as are the others but employs convex wood backing strips and standard concealed ribbed Permagrip fasteners to develop tension in either light or heavy gage panels. Diagrams courtesy Schaefer Permagrip Enterprises, 4176 West 208th street, Cleveland

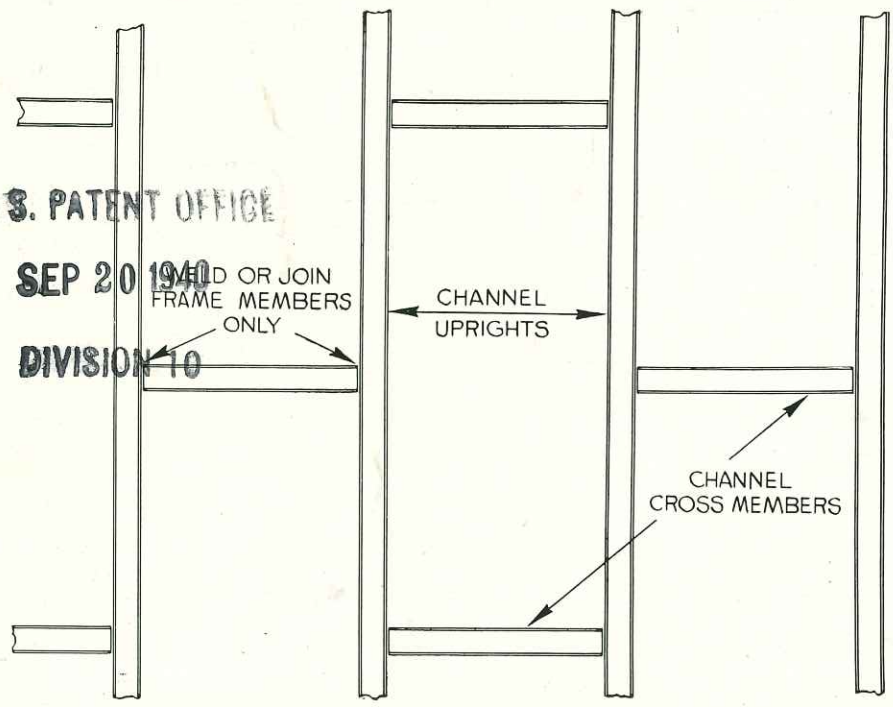
Design Aids Locking Action

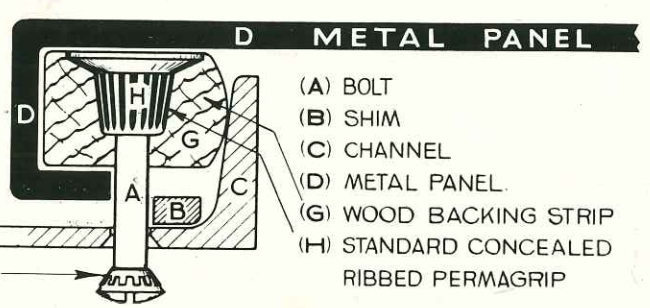
Fig. 4 shows the special Permagrip fastener developed for these applications. It is a convex, rectangular unit entirely of metal and with recesses in one side to reduce weight and with the center hole threaded to take the bolt. All four sides of the fastener are given a convex shape to provide a locking and stretching action no matter which side happens to engage the inner sloping surface of the structural channel.

An alternate method is shown in Fig. 6. Here, full length, hardwood, convex backing strips are used in the place of the inner formed channel section of Fig. 3 as means of holding down the flanged panel edge and as means of tensioning the panels. In this instance, the wood backing strip has a convex side which engages the sloping inside surface of channel C to give the tensioning action as the bolt A is drawn up to pull the backing strip into position, using a standard concealed ribbed Permagrip fastener at H. Of course, when this alternate method is used, the convex metal Permagrip fasteners and inner formed steel channels are omitted. This alternate method is suitable for light as well as heavy-gage metal panels. Note that in either case the shim B is employed underneath the wood backing strip to balance and equalize pressure exerted against the flange of the panel when the wood backing strip is pulled down in place.

Application of this new method thus is seen to make available a system of producing light and heavy-gage strain-bearing panels with all-metal construction throughout. In any case, the outer surfaces are all flush with no rivet or bolt heads In addition, the joints themselves can be sealed by running solder or other material into them and finishing off smooth with the outside surface.

Then when the outer surface is painted, it is impossible to detect where the joint was made. Such a system permits making special bodies for all types of automotive equipment. It also lends itself readily to the construction of other types of movable and stationary units. It produces high strength with modern streamlined appearance at a reasonable cost and employs only simple fabrication methods. Patent applications have been made.





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